

To our customers,

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## Old Company Name in Catalogs and Other Documents

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On April 1<sup>st</sup>, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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**MICROWAVE LOW NOISE AMPLIFIER  
NPN SILICON EPITAXIAL TRANSISTOR  
(WITH BUILT-IN 2 × 2SC5193) SMALL MINI MOLD**

**FEATURES**

- Low Voltage Operation, Low Phase Distortion
- Low Noise  
NF = 1.5 dB TYP. @V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA, f = 2 GHz  
NF = 1.7 dB TYP. @V<sub>CE</sub> = 1 V, I<sub>c</sub> = 3 mA, f = 2 GHz
- Large Absolute Maximum Collector Current  
I<sub>c</sub> = 100 mA
- A Small Mini Mold Package Adopted
- Built-in 2 Transistors (2 × 2SC5193)

**ORDERING INFORMATION**

PART NUMBER	QUANTITY	PACKING STYLE
μPA814T	Loose products (50 PCS)	Embossed tape 8 mm wide. Pin 6 (Q1 Base), Pin 5 (Q1 Emitter), Pin 4 (Q2 Emitter) face to perforation side of the tape.
μPA814T-T1	Taping products (3 KPCS/Reel)	

**Remark** If you require an evaluation sample, please contact an NEC Sales Representative. (Unit sample quantity is 50 pcs.)

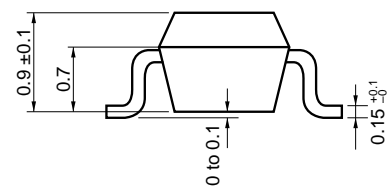
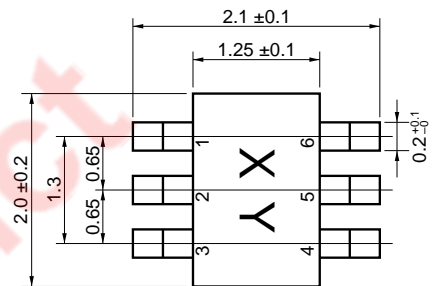
**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25 °C)**

PARAMETER	SYMBOL	RATING	UNIT
Collector to Base Voltage	V <sub>CBO</sub>	9	V
Collector to Emitter Voltage	V <sub>CEO</sub>	6	V
Emitter to Base Voltage	V <sub>EBO</sub>	2	V
Collector Current	I <sub>c</sub>	100	mA
Total Power Dissipation	P <sub>T</sub>	150 in 1 element 200 in 2 elements <sup>Note</sup>	mW
Junction Temperature	T <sub>j</sub>	150	°C
Storage Temperature	T <sub>stg</sub>	-65 to +150	°C

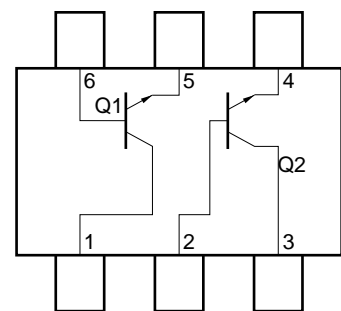
**Note** 110 mW must not be exceeded in 1 element.

**PACKAGE DRAWINGS**

(Unit: mm)



**PIN CONFIGURATION (Top View)**



**PIN CONNECTIONS**

- |                   |                 |
|-------------------|-----------------|
| 1. Collector (Q1) | 4. Emitter (Q2) |
| 2. Base (Q2)      | 5. Emitter (Q1) |
| 3. Collector (Q2) | 6. Base (Q1)    |

This device uses radio frequency technology. Take due precautions to protect it from excessive input levels such as static electricity.

The information in this document is subject to change without notice.

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)**

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Collector Cutoff Current	I <sub>CB0</sub>	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0			0.1	μA
Emitter Cutoff Current	I <sub>EB0</sub>	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0			0.1	μA
DC Current Gain	h <sub>FE</sub>	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 3 mA <sup>Note 1</sup>	80		160	
Gain Bandwidth Product (1)	f <sub>T</sub> (1)	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 3 mA, f = 2 GHz	4.0	4.5		GHz
Gain Bandwidth Product (2)	f <sub>T</sub> (2)	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 20 mA, f = 2 GHz		9.0		GHz
Feed-back Capacitance	C <sub>re</sub>	V <sub>CB</sub> = 1 V, I <sub>E</sub> = 0, f = 1 MHz <sup>Note 2</sup>		0.75	0.85	pF
Insertion Power Gain (1)	S <sub>21e</sub>   <sup>2</sup> (1)	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 3 mA, f = 2 GHz	2.5	3.5		dB
Insertion Power Gain (2)	S <sub>21e</sub>   <sup>2</sup> (2)	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 20 mA, f = 2 GHz		6.5		dB
Noise Figure (1)	NF (1)	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 3 mA, f = 2 GHz		1.7	2.5	dB
Noise Figure (2)	NF (2)	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 7 mA, f = 2 GHz		1.5		dB
h <sub>FE</sub> Ratio	h <sub>FE1</sub> /h <sub>FE2</sub>	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 3 mA A smaller value among h <sub>FE</sub> of h <sub>FE1</sub> = Q1, Q2 A larger value among h <sub>FE</sub> of h <sub>FE2</sub> = Q1, Q2	0.85			

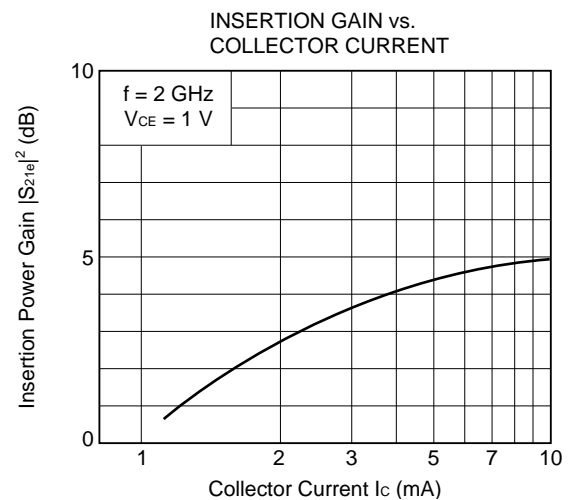
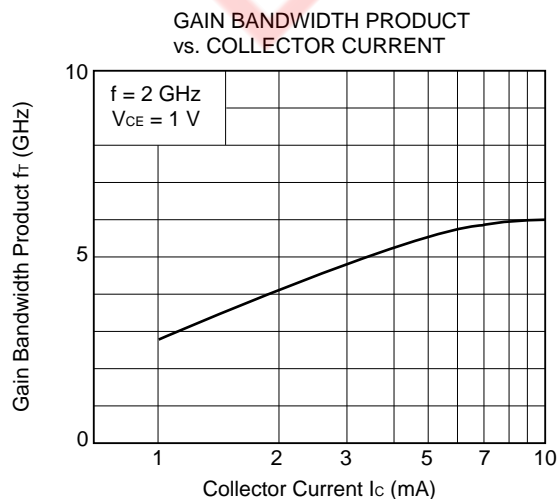
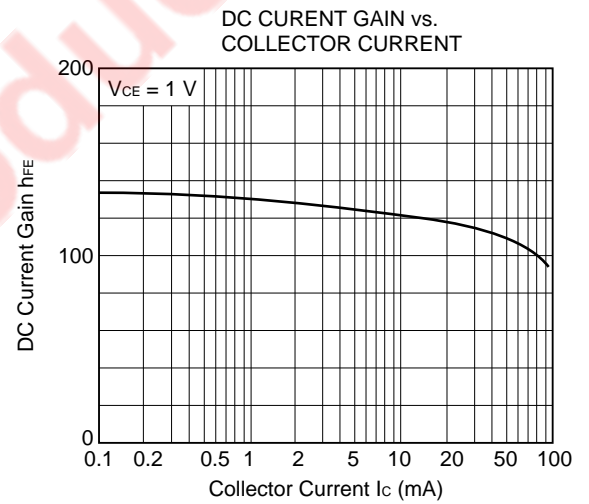
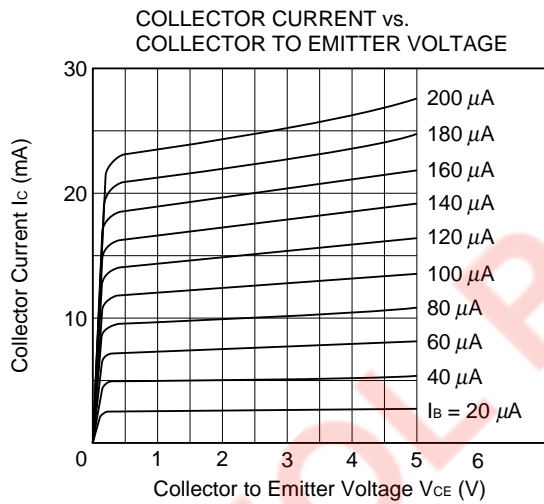
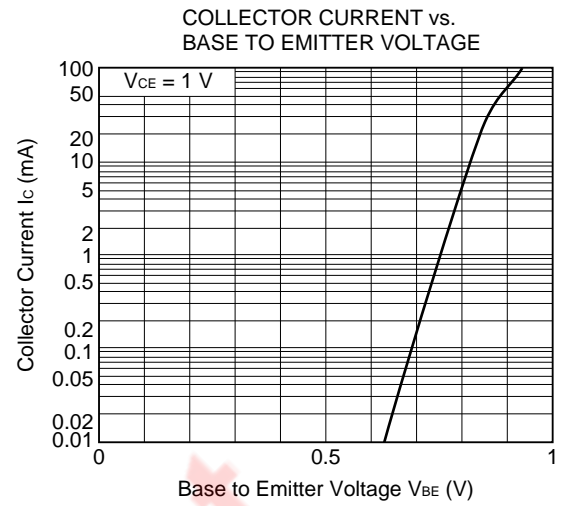
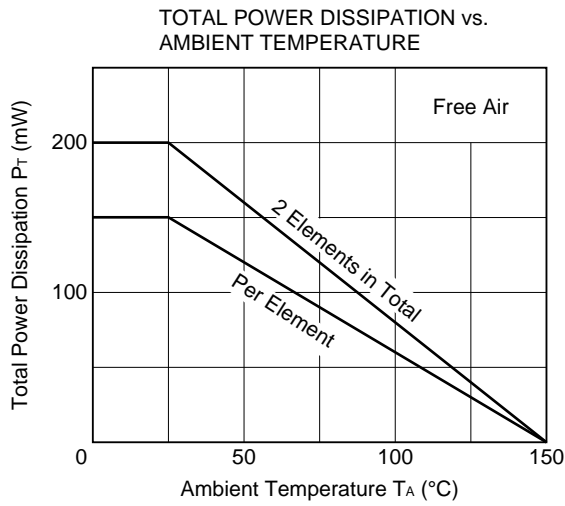
**Notes** 1. Pulse Measurement: P<sub>w</sub> ≤ 350 μs, Duty cycle ≤ 2 %

2. Measured with 3-pin bridge, emitter and case should be connected to guard pin of bridge.

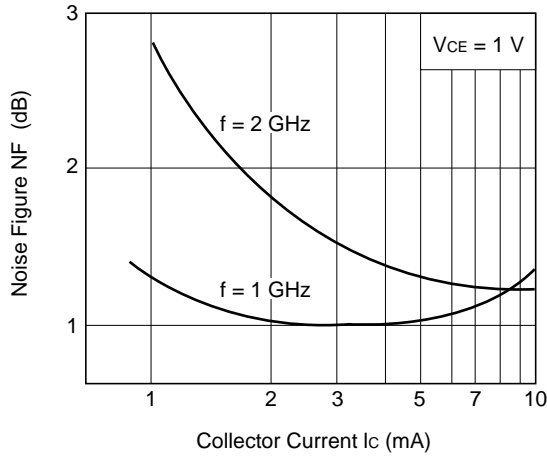
**h<sub>FE</sub> CLASSIFICATION**

Rank	KB
Marking	88T
h <sub>FE</sub> Value	80 to 160

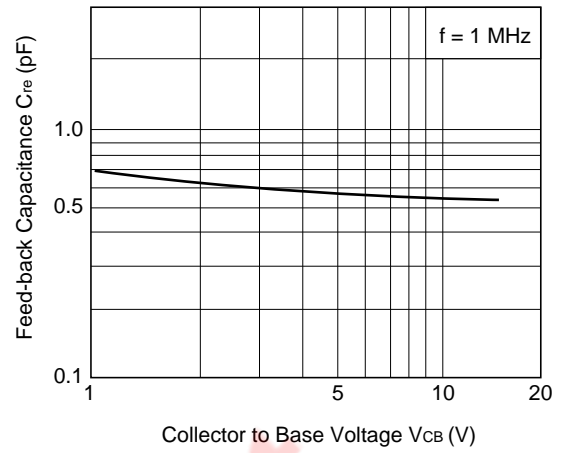
TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )



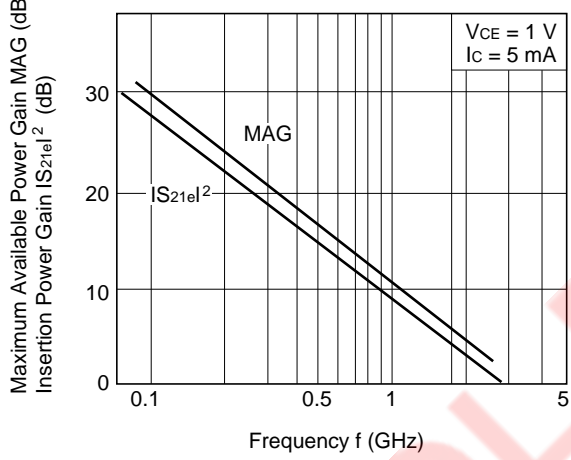
NOISE FIGURE vs. COLLECTOR CURRENT



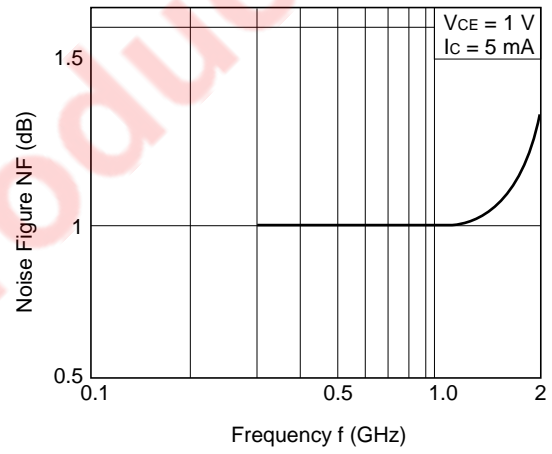
FEED-BACK CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



MAXIMUM AVAILABLE GAIN / INSERTION POWER GAIN vs. FREQUENCY



NOISE FIGURE vs. FREQUENCY



S-PARAMETERS

V<sub>CE</sub> = 1 V, I<sub>c</sub> = 1 mA

FREQUENCY		S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
100.00	0.959	-19.0	3.692	165.1	0.053	78.5	0.985	-10.2	
200.00	0.931	-35.2	3.385	152.3	0.097	68.8	0.945	-18.7	
300.00	0.849	-51.4	3.161	138.3	0.137	57.2	0.871	-28.2	
400.00	0.825	-64.7	2.868	129.8	0.166	50.6	0.817	-33.9	
500.00	0.782	-76.8	2.677	119.2	0.186	42.6	0.731	-39.2	
600.00	0.761	-91.4	2.506	112.5	0.205	38.3	0.693	-43.9	
700.00	0.725	-103.2	2.351	101.6	0.213	32.3	0.638	-47.0	
800.00	0.677	-114.4	2.224	95.2	0.225	27.6	0.609	-51.7	
900.00	0.647	-124.0	2.015	86.8	0.223	25.5	0.574	-55.3	
1000.00	0.633	-133.0	1.886	80.4	0.224	21.2	0.533	-60.7	
1100.00	0.619	-141.6	1.749	75.3	0.228	20.7	0.502	-64.6	
1200.00	0.601	-150.7	1.670	69.2	0.231	18.1	0.463	-68.5	
1300.00	0.591	-156.9	1.595	65.1	0.235	15.7	0.434	-71.7	
1400.00	0.580	-162.3	1.482	59.4	0.224	13.9	0.408	-75.0	
1500.00	0.598	-168.9	1.423	54.7	0.221	11.3	0.394	-78.4	
1600.00	0.610	-175.2	1.354	51.5	0.211	14.1	0.376	-82.7	
1700.00	0.606	176.5	1.293	47.5	0.209	13.7	0.363	-87.5	
1800.00	0.599	171.7	1.285	43.9	0.213	16.0	0.345	-93.2	
1900.00	0.585	167.3	1.238	39.1	0.213	16.0	0.333	-98.5	
2000.00	0.603	164.1	1.216	33.1	0.217	15.4	0.320	-103.8	

V<sub>CE</sub> = 1 V, I<sub>c</sub> = 3 mA

FREQUENCY		S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
100.00	0.888	-31.2	9.366	156.5	0.050	73.2	0.942	-20.2	
200.00	0.801	-56.4	8.003	138.0	0.084	61.5	0.821	-35.4	
300.00	0.682	-78.0	6.696	122.5	0.111	50.1	0.680	-48.7	
400.00	0.619	-93.8	5.670	113.3	0.126	45.6	0.572	-56.4	
500.00	0.569	-107.5	4.859	104.3	0.135	41.2	0.473	-62.6	
600.00	0.546	-121.1	4.337	99.1	0.146	40.2	0.413	-67.2	
700.00	0.518	-132.6	3.837	90.2	0.151	37.8	0.358	-70.9	
800.00	0.498	-142.3	3.529	85.6	0.162	36.5	0.322	-75.3	
900.00	0.488	-150.3	3.233	79.1	0.165	37.3	0.287	-79.6	
1000.00	0.488	-158.0	2.970	74.1	0.172	35.6	0.256	-85.3	
1100.00	0.485	-165.7	2.704	70.4	0.180	37.1	0.227	-90.3	
1200.00	0.477	-173.7	2.528	65.5	0.189	35.8	0.201	-95.8	
1300.00	0.472	-178.3	2.393	62.0	0.200	35.3	0.182	-101.3	
1400.00	0.467	178.0	2.190	57.9	0.201	34.6	0.164	-107.8	
1500.00	0.491	173.2	2.072	53.6	0.208	33.1	0.153	-114.7	
1600.00	0.508	168.8	1.954	51.4	0.213	35.8	0.143	-123.8	
1700.00	0.512	161.9	1.858	48.3	0.223	34.5	0.136	-133.6	
1800.00	0.512	157.8	1.825	45.2	0.235	35.9	0.132	-145.7	
1900.00	0.505	154.2	1.746	40.8	0.248	33.9	0.130	-155.8	
2000.00	0.520	152.1	1.704	35.5	0.260	31.8	0.131	-165.3	

V<sub>CE</sub> = 1 V, I<sub>c</sub> = 5 mA

FREQUENCY		S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
100.00	0.820	-41.1	13.583	150.1	0.045	71.6	0.898	-27.9	
200.00	0.699	-70.8	10.743	128.9	0.074	57.8	0.719	-46.7	
300.00	0.578	-94.2	8.453	113.9	0.094	48.9	0.555	-60.8	
400.00	0.515	-110.4	6.860	105.2	0.105	47.0	0.443	-69.1	
500.00	0.479	-123.8	5.735	97.6	0.115	44.7	0.355	-75.9	
600.00	0.463	-136.2	5.013	93.3	0.125	45.9	0.300	-81.3	
700.00	0.445	-146.8	4.384	85.6	0.134	44.7	0.254	-86.0	
800.00	0.437	-154.9	3.996	81.6	0.146	44.6	0.222	-92.0	
900.00	0.433	-161.7	3.464	75.6	0.154	45.5	0.194	-98.3	
1000.00	0.442	-168.5	3.334	71.4	0.164	43.9	0.170	-106.0	
1100.00	0.444	-175.3	3.026	68.2	0.174	45.3	0.149	-113.9	
1200.00	0.442	177.4	2.809	63.7	0.187	43.8	0.135	-123.4	
1300.00	0.438	173.4	2.650	60.6	0.200	43.1	0.122	-132.7	
1400.00	0.435	170.3	2.422	56.8	0.205	42.1	0.115	-143.3	
1500.00	0.461	166.8	2.285	52.9	0.216	40.3	0.117	-152.6	
1600.00	0.479	163.0	2.150	51.1	0.222	42.1	0.118	-164.4	
1700.00	0.486	156.7	2.041	48.2	0.235	40.3	0.126	-175.2	
1800.00	0.487	152.8	2.002	45.3	0.249	40.8	0.134	-174.3	
1900.00	0.484	149.6	1.905	41.2	0.264	38.1	0.145	-165.3	
2000.00	0.498	147.8	1.857	36.0	0.279	35.8	0.152	-158.7	

V<sub>CE</sub> = 1 V, I<sub>c</sub> = 7 mA

FREQUENCY MHz	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.749	-49.9	17.270	143.9	0.043	68.1	0.844	-34.8
200.00	0.611	-83.5	12.699	122.0	0.066	56.2	0.627	-55.8
300.00	0.502	-107.3	9.561	107.8	0.082	49.9	0.460	-70.5
400.00	0.451	-123.2	7.542	100.0	0.092	49.9	0.356	-79.7
500.00	0.427	-136.0	6.261	93.3	0.103	49.4	0.281	-87.2
600.00	0.418	-147.2	5.396	89.7	0.115	51.5	0.235	-93.7
700.00	0.408	-156.7	4.703	82.7	0.125	50.5	0.197	-100.6
800.00	0.405	-163.7	4.270	79.2	0.140	50.4	0.171	-108.6
900.00	0.405	-169.3	3.681	73.7	0.150	50.8	0.150	-117.7
1000.00	0.417	-175.3	3.356	69.5	0.164	49.6	0.135	-128.1
1100.00	0.424	178.6	3.205	66.9	0.174	50.1	0.122	-139.4
1200.00	0.424	171.8	2.974	62.7	0.188	48.3	0.117	-150.6
1300.00	0.421	168.1	2.806	59.6	0.203	47.3	0.114	-160.9
1400.00	0.420	165.7	2.554	56.3	0.210	46.0	0.118	-171.3
1500.00	0.445	162.5	2.404	52.4	0.222	43.9	0.125	-179.2
1600.00	0.464	159.3	2.259	50.8	0.230	45.3	0.135	171.4
1700.00	0.472	153.5	2.143	48.2	0.243	43.1	0.149	163.6
1800.00	0.476	149.8	2.099	45.3	0.258	43.3	0.162	156.6
1900.00	0.473	146.9	1.997	41.3	0.274	40.3	0.177	149.7
2000.00	0.487	145.2	1.945	36.3	0.289	37.7	0.185	145.0

V<sub>CE</sub> = 1 V, I<sub>c</sub> = 10 mA

FREQUENCY MHz	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.0	0.672	-59.5	20.710	138.2	0.040	65.0	0.784	-41.7
200.0	0.532	-95.5	14.189	116.1	0.058	56.9	0.542	-64.5
300.0	0.444	-119.1	10.380	102.9	0.073	53.2	0.384	-79.5
400.0	0.407	-134.3	8.042	96.1	0.084	53.6	0.293	-89.8
500.0	0.394	-146.0	6.581	90.1	0.096	54.0	0.229	-98.7
600.0	0.390	-156.0	5.667	87.1	0.109	56.2	0.192	-106.9
700.0	0.384	-164.7	4.903	80.6	0.122	55.6	0.163	-115.9
800.0	0.384	-170.5	4.444	77.4	0.138	54.9	0.144	-126.4
900.0	0.387	-175.2	3.836	72.3	0.149	55.2	0.133	-137.7
1000.0	0.402	179.5	3.480	68.5	0.164	53.1	0.126	-149.5
1100.0	0.411	174.0	3.328	65.9	0.176	53.4	0.120	-161.2
1200.0	0.413	167.5	3.085	62.0	0.191	51.2	0.123	-171.6
1300.0	0.411	164.3	2.906	59.0	0.206	50.2	0.125	179.5
1400.0	0.410	162.2	2.643	55.7	0.214	48.7	0.135	171.3
1500.0	0.435	159.5	2.486	52.1	0.226	46.3	0.144	165.7
1600.0	0.455	156.6	2.335	50.5	0.237	47.3	0.159	159.0
1700.0	0.465	151.1	2.213	48.0	0.250	44.8	0.173	152.8
1800.0	0.468	147.6	2.166	45.3	0.265	44.8	0.190	147.2
1900.0	0.468	144.8	2.056	41.4	0.282	41.7	0.206	142.3
2000.0	0.481	143.3	2.003	36.5	0.297	38.8	0.215	138.1

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 1 mA

FREQUENCY MHz	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.967	-16.3	3.686	167.1	0.038	79.8	0.988	-7.7
200.00	0.943	-30.5	3.405	156.0	0.071	71.8	0.962	-14.1
300.00	0.868	-44.6	3.238	143.1	0.103	61.3	0.905	-21.6
400.00	0.851	-56.7	2.983	135.8	0.126	55.5	0.868	-25.8
500.00	0.814	-67.9	2.821	125.6	0.143	48.2	0.795	-29.9
600.00	0.791	-82.1	2.687	119.4	0.159	44.3	0.770	-33.7
700.00	0.754	-93.6	2.541	108.7	0.168	38.1	0.725	-36.1
800.00	0.698	-104.5	2.419	102.4	0.179	34.1	0.702	-40.2
900.00	0.662	-114.0	2.204	94.1	0.179	31.9	0.674	-43.2
1000.00	0.641	-122.9	2.068	87.8	0.182	27.6	0.634	-47.8
1100.00	0.623	-131.7	1.924	82.9	0.184	27.2	0.602	-50.9
1200.00	0.601	-140.8	1.847	77.0	0.187	24.7	0.562	-53.9
1300.00	0.588	-147.7	1.763	73.1	0.191	22.5	0.534	-56.0
1400.00	0.576	-153.7	1.651	67.3	0.182	21.3	0.507	-58.0
1500.00	0.589	-160.9	1.589	62.8	0.181	19.4	0.496	-60.1
1600.00	0.595	-167.7	1.517	59.4	0.173	22.5	0.479	-62.8
1700.00	0.587	-176.3	1.451	55.2	0.174	22.4	0.468	-66.6
1800.00	0.577	178.5	1.438	51.7	0.177	25.2	0.452	-70.5
1900.00	0.563	173.8	1.383	46.6	0.179	25.3	0.436	-74.6
2000.00	0.580	170.1	1.355	41.1	0.182	24.8	0.421	-78.6



V<sub>CE</sub> = 3 V, I<sub>c</sub> = 3 mA

FREQUENCY MHz	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.901	-25.7	9.468	159.6	0.035	76.1	0.961	-14.7
200.00	0.824	-46.7	8.338	143.2	0.062	65.0	0.870	-26.0
300.00	0.706	-65.5	7.180	128.3	0.086	55.4	0.751	-36.3
400.00	0.642	-79.7	6.228	119.7	0.099	51.0	0.660	-41.4
500.00	0.584	-92.3	5.424	110.4	0.109	46.7	0.565	-45.5
600.00	0.550	-106.1	4.896	105.2	0.119	45.8	0.514	-48.1
700.00	0.512	-117.6	4.373	96.0	0.125	43.3	0.462	-49.6
800.00	0.477	-127.9	4.024	91.3	0.135	42.6	0.430	-52.4
900.00	0.457	-136.7	3.538	84.4	0.138	43.0	0.399	-54.4
1000.00	0.449	-145.0	3.247	79.5	0.144	41.4	0.364	-57.8
1100.00	0.438	-153.1	3.124	76.0	0.151	42.9	0.336	-60.2
1200.00	0.427	-161.4	2.924	71.3	0.159	41.8	0.306	-62.8
1300.00	0.419	-166.8	2.764	68.0	0.168	41.4	0.280	-64.2
1400.00	0.415	-171.3	2.549	63.7	0.171	41.3	0.257	-65.9
1500.00	0.434	-176.7	2.418	59.9	0.178	40.1	0.243	-67.8
1600.00	0.448	177.9	2.283	57.5	0.182	42.8	0.226	-70.5
1700.00	0.449	170.5	2.176	54.2	0.193	41.6	0.211	-74.3
1800.00	0.447	166.0	2.129	51.2	0.204	43.0	0.193	-79.0
1900.00	0.441	162.1	2.035	46.7	0.215	41.3	0.177	-83.7
2000.00	0.456	159.7	1.984	41.8	0.226	39.4	0.163	-88.2

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 5 mA

FREQUENCY MHz	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.841	-32.8	13.922	154.2	0.035	75.1	0.926	-20.2
200.00	0.726	-57.8	11.499	134.7	0.058	62.5	0.786	-34.0
300.00	0.594	-78.3	9.352	119.8	0.075	54.5	0.637	-44.6
400.00	0.519	-93.0	7.762	111.3	0.085	51.8	0.534	-49.3
500.00	0.467	-105.8	6.561	103.1	0.093	49.8	0.444	-52.5
600.00	0.439	-118.7	5.788	98.8	0.104	50.8	0.394	-54.3
700.00	0.410	-129.9	5.098	90.7	0.112	49.6	0.348	-55.1
800.00	0.390	-139.3	4.656	86.6	0.123	49.7	0.318	-57.2
900.00	0.379	-147.3	4.055	80.5	0.130	50.2	0.290	-58.9
1000.00	0.378	-155.1	3.699	76.1	0.140	49.2	0.260	-61.9
1100.00	0.373	-162.5	3.548	73.2	0.148	50.2	0.237	-64.3
1200.00	0.368	-170.3	3.298	68.9	0.158	49.1	0.210	-66.8
1300.00	0.363	-175.1	3.111	65.9	0.171	48.7	0.188	-68.4
1400.00	0.363	-178.9	2.857	62.3	0.176	47.9	0.168	-70.6
1500.00	0.384	176.6	2.699	58.5	0.186	46.6	0.155	-72.7
1600.00	0.400	172.1	2.542	56.5	0.194	48.5	0.138	-76.7
1700.00	0.405	165.4	2.421	53.7	0.205	46.5	0.123	-81.6
1800.00	0.406	161.3	2.365	50.8	0.218	47.3	0.108	-89.2
1900.00	0.403	157.7	2.254	46.6	0.231	44.8	0.093	-97.0
2000.00	0.418	155.7	2.194	41.8	0.245	42.5	0.081	-105.9

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 7 mA

FREQUENCY MHz	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.775	-39.4	17.958	148.6	0.032	71.8	0.887	-25.1
200.00	0.633	-67.5	13.904	127.9	0.052	61.3	0.704	-40.5
300.00	0.503	-88.8	10.822	113.2	0.067	55.4	0.545	-50.6
400.00	0.433	-103.6	8.710	105.4	0.076	54.8	0.441	-54.7
500.00	0.390	-116.1	7.271	98.3	0.085	53.6	0.360	-57.0
600.00	0.369	-128.4	6.330	94.7	0.096	55.7	0.314	-58.2
700.00	0.350	-139.1	5.532	87.3	0.107	54.9	0.274	-58.7
800.00	0.338	-147.8	5.024	93.7	0.120	55.0	0.247	-60.3
900.00	0.333	-154.9	4.354	78.2	0.128	55.5	0.222	-62.0
1000.00	0.337	-162.1	3.950	74.1	0.139	53.7	0.197	-65.1
1100.00	0.336	-168.9	3.621	71.2	0.149	54.6	0.175	-67.3
1200.00	0.334	-176.5	3.521	67.6	0.161	53.2	0.152	-70.4
1300.00	0.333	179.2	3.316	64.7	0.174	52.5	0.133	-72.3
1400.00	0.334	176.1	3.041	61.3	0.181	51.4	0.115	-75.4
1500.00	0.356	172.2	2.864	57.8	0.192	49.7	0.102	-78.5
1600.00	0.371	168.2	2.698	55.9	0.201	51.4	0.087	-84.2
1700.00	0.380	161.9	2.565	53.3	0.214	49.2	0.074	-92.8
1800.00	0.382	158.1	2.502	50.6	0.228	49.4	0.063	-108.0
1900.00	0.382	154.9	2.380	46.6	0.241	46.4	0.052	-124.8
2000.00	0.397	153.1	2.314	41.9	0.256	43.9	0.047	-143.3

V<sub>CE</sub> = 3 V, I<sub>c</sub> = 10 mA

FREQUENCY MHz	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.704	-46.5	21.888	143.4	0.030	70.3	0.841	-30.3
200.00	0.545	-76.9	15.924	121.8	0.046	61.5	0.623	-46.2
300.00	0.426	-98.4	11.954	108.0	0.061	56.6	0.463	-55.4
400.00	0.365	-113.1	9.399	100.9	0.071	57.1	0.366	-58.8
500.00	0.335	-125.5	7.735	94.7	0.081	57.4	0.296	-60.4
600.00	0.320	-137.0	6.694	91.6	0.093	60.1	0.254	-61.2
700.00	0.307	-147.2	5.821	84.9	0.104	59.5	0.220	-61.2
800.00	0.301	-154.8	5.283	81.6	0.118	59.2	0.195	-62.5
900.00	0.300	-161.4	4.566	76.6	0.128	59.1	0.173	-64.7
1000.00	0.308	-167.7	4.143	72.7	0.141	57.3	0.151	-67.7
1100.00	0.310	-174.3	3.703	70.0	0.151	57.6	0.131	-70.2
1200.00	0.312	178.7	3.537	66.3	0.163	56.0	0.109	-74.2
1300.00	0.311	174.8	3.459	63.8	0.178	55.1	0.094	-76.7
1400.00	0.314	172.0	3.168	60.6	0.185	53.9	0.077	-82.0
1500.00	0.335	168.8	2.981	57.3	0.198	51.8	0.066	-87.7
1600.00	0.353	165.2	2.806	55.6	0.207	53.0	0.053	-98.3
1700.00	0.362	159.2	2.666	53.1	0.221	50.6	0.044	-116.1
1800.00	0.365	155.7	2.599	50.4	0.235	50.6	0.040	-141.9
1900.00	0.367	152.6	2.473	46.5	0.249	47.5	0.041	-169.7
2000.00	0.382	150.9	2.402	41.9	0.263	44.9	0.050	171.7

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